



US006171881B1

**(12) United States Patent
Fujii****(10) Patent No.: US 6,171,881 B1
(45) Date of Patent: Jan. 9, 2001****(54) ACCELERATION SENSOR AND PROCESS
FOR THE PRODUCTION THEREOF**

5,243,861 9/1993 Kloeck et al. .

(List continued on next page.)

(75) Inventor: Tetsuo Fujii, Kariya (JP)**FOREIGN PATENT DOCUMENTS****(73) Assignee: Denso Corporation, Kariya (JP)**

2240178 7/1991 (GB) .

60-266864 12/1985 (JP) .

61-73071 4/1986 (JP) .

62-27666 2/1987 (JP) .

62-207917 9/1987 (JP) .

404076956A 3/1992 (JP) .

6-88837 3/1994 (JP) .

8-510837 11/1996 (JP) .

(*) Notice: Under 35 U.S.C. 154(b), the term of this patent shall be extended for 0 days.**(21) Appl. No.: 09/457,349****(22) Filed: Dec. 9, 1999****OTHER PUBLICATIONS****Related U.S. Application Data****(62)** Division of application No. 08/566,600, filed on Dec. 4, 1995, which is a continuation of application No. 08/167,976, filed on May 11, 1994, now abandoned.**(30) Foreign Application Priority Data**

Apr. 27, 1992 (JP) 4-108020

(51) Int. Cl.⁷ H01L 21/00**(52) U.S. Cl. 438/52; 438/50; 257/415****(58) Field of Search 438/50, 52, 456,
438/459; 257/415, 416, 417, 418, 419****(56) References Cited****U.S. PATENT DOCUMENTS**

4,483,194	11/1984	Rudolf .	
4,507,705	3/1985	Hoshino et al. .	
4,574,327	3/1986	Wilner .	
4,598,585	7/1986	Boxenhorn .	
4,653,326	3/1987	Danel et al. .	
4,679,434	7/1987	Stewart .	
4,711,128	12/1987	Boura .	
4,783,237	11/1988	Aine et al. .	
4,891,984	1/1990	Fujii et al. .	
4,951,510	8/1990	Holm-Kennedy et al. .	
5,006,487	4/1991	Stokes .	
5,008,774	4/1991	Bullis et al. .	
5,115,291	5/1992	Stokes .	
5,149,673 *	9/1992	MacDonald et al.	437/192
5,151,763	9/1992	Marek et al. .	
5,198,390 *	3/1993	MacDonald et al.	437/203

Payne et al.: "Surface Micromachined Accelerometer: A Technology Update", SAE Technical Paper Series, Feb. 25, 1991, pp. 127-135.

* cited by examiner

Primary Examiner—Donald L. Monin, Jr.*Assistant Examiner*—Ginette Peralta**(74) Attorney, Agent, or Firm**—Pillsbury Madison & Sutro LLP**(57) ABSTRACT**

A single crystal silicon substrate (1) is bonded through an SiO₂ film (9) to a single crystal silicon substrate (8), and the single crystal silicon substrate (1) is made into a thin film. A cantilever (13) is formed on the single crystal silicon substrate (1), and the thickness of the cantilever (13) in a direction parallel to the surface of the single crystal silicon substrate (1) is made smaller, than the thickness of the cantilever in the direction of the depth of the single crystal silicon substrate (1), and movable in a direction parallel to the substrate surface. In addition, the surface of the cantilever (13) and the part of the single crystal silicon substrate (1), opposing the cantilever (13), are, respectively, coated with an SiO₂ film (5), so that an electrode short circuit is prevented in a capacity-type sensor. In addition, a signal-processing circuit (10) is formed on the single crystal silicon substrate (1), so that signal processing is performed as the cantilever (13) moves.

13 Claims, 15 Drawing Sheets